IN THE CLAIMS

Please amend the claims as follows:

Claim 1 (Currently Amended): A time-varying multi-path generating apparatus for simulating multi-path fluctuations in radio communications between a transmission point and a receiving point, comprising:

a parameter control unit for controlling a plurality of conditions for generating a plurality of propagation paths, the conditions being parameters and data files,

a data storage unit for storing the parameters and data files for generating the propagation paths,

a random number generating unit for generating and outputting a plurality of random numbers based on a random number parameter provided by the parameter control unit,

a propagation path generating unit for generating a plurality of time-varying propagation paths, and

a buffer memory unit configured to store the generated time-varying propagation paths, wherein

a plurality of time-varying amplitude functions and a plurality of time-varying phase functions are generated based on the parameters and data files for propagation path generation stored in the data storage unit, and the random numbers generated by the random number generating unit,

the time-varying amplitude functions are aligned serially in the time domain such that a time-varying shadow amplitude function is obtained, which is repeated N times, where N represents the number of the propagation paths, resulting in N time-varying shadow amplitude functions,

the time-varying phase functions are aligned serially in the time domain such that a time-varying shadow phase function is obtained, which is repeated N times, where N

represents the number of the propagation paths, resulting in N time-varying shadow phase functions,

an initial amplitude, an initial phase, an initial time delay, and an initial arrival direction are generated as the propagation path parameters of a propagation path using random numbers provided by the random number generating unit based on the initial value generation parameters stored in the data storage unit, and

the time-varying shadow amplitude functions and the time-varying shadow phase functions are superimposed on the initial amplitude and the initial phase, respectively, for generating a plurality of time-varying propagation paths,

wherein, when generating the time varying propagation paths, if a shadowing object is present in the line of sight, a received electric field strength E is given as the summation of E1 that is an electric field strength of a first radio propagation path diffracted by a knife-edge at one edge of said shadowing object and E2 that is an electric field strength of a second radio propagation path that is different from the first propagation path and diffracted by a knife-edge at another opposite edge of said shadowing object,

said first radio propagation path starts at the transmission point, does not pass the another edge of said shadowing object, and is diffracted at the one edge of said shadowing object before reaching the receiving point,

said second radio propagation path starts at the transmission point, does not pass the one edge of said shadowing object, and is diffracted at the another edge of said shadowing object before reaching the receiving point, and

~~which is located~~ said shadowing object is between the first and second radio propagation paths.

Claim 2 (Currently Amended): A time-varying multi-path generating apparatus for simulating multi-path fluctuations in radio communications between a transmission point and a receiving point, comprising:

a parameter control unit for controlling a plurality of conditions for generating a plurality of propagation paths, the conditions being parameters and data files,

a data storage unit for storing the parameters and data files for generating the propagation paths,

a random number generating unit for generating and outputting a plurality of random numbers based on a random number parameter provided by the parameter control unit,

a time-varying function generating unit for generating and outputting a plurality of time-varying amplitude functions and time-varying phase functions, serving as shadow characteristics of the propagation paths based on a shadow parameter stored in the data storage unit and the random numbers provided by the random number generating unit,

a propagation path generating unit for generating a plurality of time-varying propagation paths, and

a buffer memory unit configured to store the generated time-varying propagation paths, wherein

the time-varying amplitude functions and the time-varying phase functions generated and provided by the time-varying function generating unit are aligned serially in the time domain such that a time-varying shadow amplitude function and a time-varying shadow phase function, respectively, are obtained, which obtaining is repeated N times, where N represents the number of the propagation paths, resulting in N time-varying shadow amplitude functions and N time-varying shadow phase functions, respectively,

an initial amplitude, an initial phase, an initial time delay, and an initial arrival direction are generated as the propagation path parameters of a propagation path using the

random numbers provided by the random number generating unit based on initial value generation parameters stored in the data storage unit, and

the time-varying shadow amplitude function and the time-varying shadow phase function are superimposed on the initial amplitude and the initial phase, respectively, for generating a plurality of time-varying propagation paths,

wherein, when generating the time varying propagation paths, if a shadowing object is present in the line of sight, a received electric field strength E is given as the summation of E1 that is an electric field strength of a first radio propagation path diffracted by a knife-edge at one edge of said shadowing object and E2 that is an electric field strength of a second radio propagation path that is different from the first propagation path and diffracted by a knife-edge at another opposite edge of said shadowing object,

said first radio propagation path starts at the transmission point, does not pass the another edge of said shadowing object, and is diffracted at the one edge of said shadowing object before reaching the receiving point,

said second radio propagation path starts at the transmission point, does not pass the one edge of said shadowing object, and is diffracted at the another edge of said shadowing object before reaching the receiving point, and

~~which is located~~ said shadowing object is between the first and second radio propagation paths.

Claim 3 (Original): The time-varying multi-path generating apparatus as claimed in claim 1, wherein the propagation path generating unit generates the time-varying amplitude functions and the time-varying phase functions using the random numbers generated by the random number generating unit; the random numbers have correlations corresponding to inter-parameter correlation characteristics related to an arriving propagation path angle

difference that is stored in the data storage unit for each of the propagation paths; and a shadow time interval, a shadow amplitude, and a shadow occurrence time interval are generated as correlated random numbers that are used as constant parameters of a time-varying function.

Claim 4 (Original): The time-varying multi-path generating apparatus as claimed in claim 1, wherein the propagation path generating unit adds a time-varying phase rotation to the time-varying phase characteristic of each time-varying propagation path by calculating the time-varying rotation due to the Doppler effect based on a moving speed of a mobile station, the moving speed being provided by the parameter control unit, and the initial arriving direction of each propagation path.

Claim 5 (Original): The time-varying multi-path generating apparatus as claimed in claim 1, wherein:

the data storage unit stores directional-gain pattern files of a plurality of antennas applicable to a mobile station, the directional-gain pattern files being provided by the parameter control unit, and containing information about directional gain, and

the propagation path generating unit reads at least one of the directional-gain pattern files according to moving directions of the mobile station, calculates N propagation paths by multiplying the directional gain to the initial amplitude of each propagation path to obtain N time-varying propagation paths, which is repeated M times, M being the number of the antennas, and NxM time-varying propagations propagation paths are generated.

Claim 6 (Currently Amended): A multi-path fading simulator <u>for simulating multi-path fading between a transmission point and a receiving point</u>, comprising:

a time-varying multi-path generating apparatus for generating N time-varying propagation paths for each of M antennas,

a buffer memory configured to store the generated time-varying propagation paths,

a propagation path output unit for dividing MxN complex amplitudes of the time-varying propagation paths provided by the time-varying multi-path generating apparatus into real parts and imaginary parts, and outputting the real parts and the imaginary parts in an analog form, and

a signal synthesizing unit, comprising:

at least one digital signal input terminal,

at least one digital signal output terminal,

an orthogonal signal generating unit for generating a plurality of orthogonal input signals (Q component) based on a plurality of digital signals (I component) input through the digital signal input terminal,

2xM transversal circuits, each comprising (N-1) delay elements that are cascaded, and N multipliers, wherein

each of the I component and the Q component is distributed to specific transversal circuits,

each of the N multipliers is provided with the respective real part, or the respective imaginary part, as applicable, output by the propagation path output unit, the real part or the imaginary part, as applicable, having an initial time delay, and the time delay of each multiplier is set equal to the time delay of the real part or the imaginary part, as applicable, and

each digital signal delayed by 0, one or more delay elements, as applicable, and the propagation path fluctuation that is represented by the real part or the imaginary part, as applicable, are multiplied, and

M signal synthesizing units for adding the multiplication results of every delay time such that the I component and the Q component are obtained, for combining the I component and the Q component such that a digital signal is generated for each of M antennas, and for outputting the digital signal to the digital signal output terminal,

wherein, when generating the time varying multi-paths, if a shadowing object is present in the line of sight, a received electric field strength E is given as the summation of E1 that is an electric field strength of a first radio propagation path diffracted by a knife-edge at one edge of said shadowing object and E2 that is an electric field strength of a second radio propagation path that is different from the first propagation path and diffracted by a knife-edge at another opposite edge of said shadowing object,

said first radio propagation path starts at the transmission point, does not pass the another edge of said shadowing object, and is diffracted at the one edge of said shadowing object before reaching the receiving point,

said second radio propagation path starts at the transmission point, does not pass the one edge of said shadowing object, and is diffracted at the another edge of said shadowing object before reaching the receiving point, and

~~which is located~~ said shadowing object is between the first and second radio propagation paths.

Claim 7 (Currently Amended): A time-varying multi-path generating method for simulating multi-path fluctuations in radio communications between a transmission point and a receiving point, comprising:

a step wherein a plurality of propagation path generation parameters and data files of propagation paths to be generated are stored in a data storage unit, the data files comprising

propagation path generation parameter files, antenna directional gain pattern files, and time-varying function constant parameter generation condition files,

a step wherein the parameter control unit reads the propagation path generation parameter files from the data storage unit

a step wherein the parameter control unit reads data files about M antennas, such as the antenna directional gain pattern files, from the data storage unit,

a step wherein the random number generating unit generates random numbers that fulfill propagation path parameter initial value generation conditions of a propagation path to be generated,

a step wherein the propagation path generating unit sets up initial conditions, such as initial amplitude values of N propagation path parameters based on the random numbers,

a step wherein the N initial amplitude values and antenna directional gains to a direction of an incoming propagation path obtained from the antenna directional gain pattern file are multiplied to obtain NxM propagation path parameters, which parameters are set up,

a step wherein the parameter control unit reads the time-varying function constant parameter generation condition files from the data storage unit,

a step wherein the propagation path generating unit generates time-varying function constant parameters based on random numbers generated by the random number generating unit,

a step wherein the propagation path generating unit generates time-varying shadow amplitude characteristics and time-varying shadow phase characteristics of N propagation paths based on the time-varying function constant parameters, and generates shadow fluctuation characteristics of the amplitude and the phase of each of the N propagation paths, and

a step wherein time-varying multi-paths are generated based on the generated shadow fluctuation characteristics and output from the propagation path generating unit,

wherein, when generating the time varying propagation paths, if a shadowing object is present in the line of sight, a received electric field strength E is given as the summation of E1 that is an electric field strength of a first radio propagation path diffracted by a knife-edge at one edge of said shadowing object and E2 that is an electric field strength of a second radio propagation path that is different from the first propagation path and diffracted by a knife-edge at another opposite edge of said shadowing object,

said first radio propagation path starts at the transmission point, does not pass the another edge of said shadowing object, and is diffracted at the one edge of said shadowing object before reaching the receiving point,

said second radio propagation path starts at the transmission point, does not pass the one edge of said shadowing object, and is diffracted at the another edge of said shadowing object before reaching the receiving point, and

~~which is located~~ said shadowing object is between the first and second radio propagation paths.

Claim 8 (Currently Amended): A time-varying multi-path generating method for simulating multi-path fluctuations in radio communications between a transmission point and a receiving point, comprising:

a step wherein a plurality of propagation path generation parameters and data files of propagation paths to be generated are stored in a data storage unit, the data files comprising propagation path generation parameter files, antenna directional gain pattern files, and time-varying function constant parameter generation condition files,

a step wherein the parameter control unit reads the propagation path generation parameter files from the data storage unit,

a step wherein the parameter control unit reads data files about M antennas, such as the antenna directional gain pattern files, from the data storage unit,

a step wherein the random number generating unit generates random numbers that fulfill propagation path parameter initial value generation conditions of a propagation path to be generated,

a step wherein a propagation path generating unit sets up initial conditions, such as initial amplitude values of N propagation path parameters based on the random numbers,

a step wherein the N initial amplitude values and antenna directional gains corresponding to a direction of an incoming propagation path obtained from the antenna directional gain pattern file are multiplied to obtain NxM propagation path parameters, which parameters are set up,

a step wherein the parameter control unit specifies a calculation model based on the propagation path generation parameter files,

a step wherein the random number generating unit generates random numbers corresponding to shadow parameters,

a step wherein the time-varying function generating unit generates N time-varying functions for the specified calculation model based on the random numbers, and

a step wherein, time-varying shadow amplitude characteristics and time-varying shadow phase characteristics are generated for N propagation paths based on the generated time-varying functions generated by the propagation path generating unit, which amplitude characteristics and phase characteristics are multiplied by the amplitude and the phase, respectively, of each propagation path such that shadow fluctuation characteristics are generated, and

a step wherein time-varying multi-paths are generated based on the generated shadow fluctuation characteristics and output from the propagation path generating unit,

wherein, when generating the time varying multi-paths, if a shadowing object is present in the line of sight, a received electric field strength E is given as the summation of E1 that is an electric field strength of a first radio propagation path diffracted by a knife-edge at one edge of said shadowing object and E2 that is an electric field strength of a second radio propagation path that is different from the first propagation path and diffracted by a knife-edge at another opposite edge of said shadowing object,

said first radio propagation path starts at the transmission point, does not pass the another edge of said shadowing object, and is diffracted at the one edge of said shadowing object before reaching the receiving point,

said second radio propagation path starts at the transmission point, does not pass the one edge of said shadowing object, and is diffracted at the another edge of said shadowing object before reaching the receiving point, and

~~which is located~~ said shadowing object is between the first and second radio propagation paths.